EUB

Allowables Handbook

Guidelines for the Calculation of Monthly Production Allowables in Alberta

December 2001
(Revised September 2003)

Alberta Energy and Utilities Board

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ALBERTA ENERGY AND UTILITIES BOARD
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1 Introduction

The Alberta Energy and Utilities Board (EUB/Board) has developed this guide to explain the factors used and calculations involved in the determination of monthly allowables for production entities (well, block or project). Allowables, or Maximum Rate Limitations (MRL), are rate controls applied primarily to oil entities in accordance with a Board order and are the major focus of this guide. Allowables are assigned to new pools where conservation is or could potentially be an issue and help ensure that enhanced oil recovery feasibility and gas conservation are addressed before pools are significantly depleted. Allowables help to minimize gas cap depletion until decisions are made on concurrent production and also serve to maintain intra-pool equity. For gas wells, allowables are applied primarily for equity reasons in the administration of off-target penalties (see Section 7).

Examples are presented to illustrate overall concepts and procedures, and a glossary is included for reference. All figures cited in the guide appear at the end.

The EUB plans to update this guide as amendments are made to the allowables system, but operators must assume ultimate responsibility to keep up to date about any changes introduced through EUB informational letters (ILs), interim directives (IDs), and changes to the Oil and Gas Conservation Act or Regulations. In the event of conflict between this guide and the Act, Regulations, or various active ILs and IDs, the latter take precedence.

For further clarification on any topic presented in this guide, contact the Reserves and Allowables Section of the EUB Geology and Reserves Group at (403) 297-8354 or (403) 297-8566.

2 Base Maximum Rate Limitation (MRL)

The base MRL is the maximum rate of production that applies prior to the application of gas-oil ratio or off-target penalties (see Section 3). The standard base MRL assigned to a single-well pool is the greater of the reserve-based Preliminary Rate Limitation (PRL) or the Basic Well Rate (BWR) (see Figure 1). The PRL (expressed in cubic metres per day [m^3/d]) is calculated as the product of a pool's recoverable oil reserves (in units of thousands [10^3] m^3) and the constant 0.296. Continuous production at the PRL rate would deplete a pool in 9.25 years. For multiwell pools, a well's base MRL is the pool MRL divided by the number of non-abandoned oil wells in the pool.

Example

Number of nonabandoned oil wells in the pool = 2

BWR = 10.0 m^3/d/well

Recoverable reserves (RiN) = 98.0 10^3 m^3

Pool MRL = 98.0 x 0.296 = 29.0 m^3/d

Well base MRL = the greater of the BWR or

$$\frac{\text{pool MRL}}{\text{number of nonabandoned oil wells}}$$

$$= \text{the greater of } 10.0 \text{ m}^3/\text{d or } \frac{29.0 \text{ m}^3/\text{d}}{2}$$

= 14.5 m^3/d

2.1 Nonconfidential Pools—MRL Order

The EUB issues monthly MRLs through the MRL Order posted on the EUB Web site several days prior to the month in which it applies. The MRL Order lists the MRLs for all active nonconfidential oil pools, including pools subject to Good Production Practice (GPP). Pools subject to GPP are not restricted by a base MRL or GOR penalties; however, any special conditions prescribed in Appendix II of the MRL Order must be adhered to. Operators producing under GPP are expected to produce the wells in accordance with good engineering practices to optimize oil recovery.

The MRL Order contains two appendices: Appendix I contains base MRL data on all nonconfidential pools; Appendix II (Special Provisions) provides details on any applicable special requirements that were prescribed in Column 7 of Appendix I. Operators producing from pools subject to special provisions must determine whether these provisions apply to the specific production entity they operate.

It is important for operators to refer to the MRL Order on a monthly basis to ensure that all relevant data for calculating a given monthly allowable is taken into account. An example of Appendix I to the MRL Order is given in Figure 2, and definitions for each column of the data on the appendix are in Figure 3.

Calculation of a monthly base MRL (i.e., unpenalized MRL, or the MRL before any reduction due to penalties [see Section 3]) for a single well within a defined pool is equal to the MRL as set out in column 5 of Appendix I times the number of days in the month.

Example

To calculate the base MRL for a well in the Ante Creek Dunvegan D Pool (see Figure 2: Appendix I to the MRL Order):

Base MRL from Column 5	=	12.0 m^3/d
Number of days in the month	=	31
Base MRL	=	Daily base MRL x number of days in the month
	=	12.0 m^3/d x 31 d = 372.0 m^3 for the month

This monthly base MRL may be subject to reduction by any applicable penalties, as described in Section 3.

2.2 Confidential Pools—Form O-38

Allowables for wells producing from confidential pools are not listed in the MRL Order but are prescribed on the EUB Form O-38: Application for a New Well Base Allowable or Base MRL (see Figure 4 for sample Form O-38).

For wells that define a new pool or wells drilled outside existing pool order boundaries, operators must complete an O-38 form in duplicate and submit to the EUB Geology and Reserves Group within 30 days of initial production. Where applicable, the EUB will assign a base MRL and a base GOR. The O-38 form is returned to the operator for use in calculating allowables for the well.

Calculation of the base MRL for a single well producing from a confidential pool is the product of the base MRL as indicated on Form O-38 multiplied by the number of days in the month.

Example

To calculate the base MRL for a well from EUB form O-38:

MRL from O-38	=	18.0 m^3/d
Number of days in the month	=	31
Base MRL	=	Daily base MRL x number of days in the month
	=	18.0 m^3/d x 31 d = 558.0 m^3 for the month

This monthly base MRL may be subject to reduction by any applicable penalties, defined in Section 3.

For undefined wells for which an O-38 has not been approved and an MRL has not been assigned, the EUB will assume an interim MRL of 8.0 m^3/d and a base GOR of 70 m^3/m^3 following the new oil well production period (NOWPP), defined in Section 6.

2.3 Horizontal Well Modifier (HWM)

The horizontal well modifier (HWM) was introduced in *ID 97-1: Horizontal Oil Wells—Revised Production Rate Limitation* to encourage, where appropriate, the drilling of horizontal wells rather than multiple vertical wells. The HWM is a factor which when

multiplied by the well base MRL increases the allowable in relation to the horizontal length of the well.

Rules governing allowables for horizontal wells are as follows:

- An HWM is approved upon request in writing by an operator.
- The base MRL is equal to the product of the HWM and the base MRL that would be assigned to a vertical well, where

  HWM = square root of (1 + L/100), truncated to 1 decimal, and L = length of the well's horizontal section in metres, calculated as the difference in log depth from the pay top of the productive zone to the well's total depth (TD) or plugback depth.
- During NOWPP, the base MRL is the greater of 20.0 m^3/d or the well base MRL multiplied by the HWM, subject to all other conditions of the NOWPP.
- In pools subject to special MRL, the base MRL is equal to the HWM multiplied by the special MRL.
- HWMs are specified in clause 9a of Appendix II to the MRL Order for nonconfidential pools, and on EUB Form O-38 for confidential pools.

Figure 5 illustrates the following example of a base MRL calculation for a well assigned an HWM:

Base MRL of a horizontal well during NOWPP:

NOWPP MRL	= 20.0 m^3/d
HWM	= 2.0
Number of days in the month	= 30
Base MRL	= NOWPP MRL x HWM x days in the month
	= 20.0 m^3/d x 2.0 x 30 d
	= 1200.0 m^3 for the month

Base MRL of a horizontal well on MRL (after NOWPP):

MRL	= 8.0 m^3/d
HWM	= 2.0
Number of days in the month	= 31
Base MRL	= Daily MRL x HWM x days in the month
	= 8.0 m^3/d x 2.0 x 31 d
	= 496.0 m^3 for the month

3 Penalties

3.1 Gas-Oil Ratio (GOR) Penalty

GOR penalties are applied to production entities when the producing GOR exceeds the base GOR. They are imposed to limit production primarily to optimize oil and gas conservation. The base GOR is prescribed in Column 6 of Appendix I to the MRL Order for non-confidential pools and on EUB Form O-38 for confidential pools.

The base GOR is determined from the formula shown below, as set out in Schedule 6 of the Oil and Gas Conservation Regulations:

$$\text{Base GOR } (m^3/m^3) = Rsi + \frac{1.67\,(Pb + 101.325)}{Tf + 273.15}$$

Where Rsi = initial solution GOR
Pb = bubble point pressure
Tf = reservoir temperature

The reservoir parameters used in the formula are determined from Pressure Volume Temperature (PVT) analysis, when available, or from standings correlation.

The GOR penalty factor is calculated as the base GOR divided by the producing GOR. This penalty factor is then multiplied by the base MRL to determine the adjusted MRL. Note that the EUB reports gas production in units of 10^3 m^3 and oil in units of m^3.

Example, given a well with the following production data:

Monthly base MRL = 372.0 m^3 (calculated from example in Section 2.1)
Base GOR = 130 m^3/m^3
Monthly oil production = 219.2 m^3
Monthly gas production = 56.1 10^3 m^3

$$\text{Produced GOR} = \frac{\text{Gas production}}{\text{Oil production}} = \frac{56.1\ 10^3\ m^3}{219.2\ m^3} = 256\ m^3/m^3$$

$$\text{GOR penalty factor} = \frac{\text{Base GOR}}{\text{Produced GOR}} = \frac{130\ m^3/m^3}{256\ m^3/m^3} = 0.51$$

Adjusted MRL = monthly base MRL x GOR penalty factor
= 372.0 m^3/month x 0.51
= 189.7 m^3 for the month

Note that the GOR penalty factor is equal to 1.0 when the produced GOR is less than or equal to the base GOR.

3.1.1 Application of the GOR Penalty Factor

The adjusted MRL for a given month is calculated using the GOR penalty factor from the **third preceding month**. This enables operators to forecast future months' allowables using available production data. For example, when calculating the penalized MRL for April, use the GOR penalty factor from the January production data. If there is no production in the third preceding month (January), then use the second preceding month (February). If there is no production in the second preceding month (February), then use the first preceding month (March). Use the current-month GOR penalty factor against that month and the following three months if there has been no production over the previous three months or if the entity is subject to any of the following changes:

- base GOR change
- net GOR penalty relief (commencement of gas conservation)
- first month after NOWPP
- first month after production test
- formation of a new block or project
- GPP rescinded

3.1.2 Net GOR Penalty Relief

Where gas is conserved and upon successful application, the EUB may grant relief from GOR penalties on the basis of net gas production. Application for GOR penalty relief is made under Section 10.060 of the Oil and Gas Conservation Regulations in accordance with EUB *Guide 65: Resources Applications for Conventional Oil and Gas Reservoirs.*

Net GOR penalty relief is the application of a net GOR penalty factor where the producing GOR is calculated not on the month's total gas production but only on the volume of gas flared and vented. If the net produced GOR is less than the base GOR, the GOR penalty factor is equal to 1.0.

$$\text{Net Produced GOR} = \frac{\text{Gas flared + vented}}{\text{Oil production}}$$

$$\text{Net GOR penalty factor} = \frac{\text{Base GOR}}{\text{Net produced GOR}}$$

Multiwell facilities must prorate the battery flared/vented volume to individual wells based on their prorated share of total battery production (reported through the volumetric submission to the Petroleum Registry of Alberta).

$$\text{Well's gas flared/vented} = \frac{\text{Well's gas production x (total battery flared + vented)}}{\text{Total battery gas production (includes other receipts)}}$$

3.2 Off-Target Penalty

When a well is completed outside its prescribed target area, an off-target penalty factor may be imposed against the base MRL. The following conditions apply to off-target penalties:

1) Industry is responsible for surveillance of off-target wells. An off-target penalty is assessed upon successful application from a competitive operator.

2) Off-target penalties do not apply to the first well in a pool.

3) The off-target penalty factor is always applied to the base MRL first, followed by any applicable GOR penalties.

4) The off-target penalty factor normally does not reduce the base MRL below 5.0 m^3/d.

5) For GPP pools, the EUB determines (when necessary, with the input from affected parties) the rate against which to apply the off-target penalty.

6) Off-target penalties in effect are listed in clause 5 (GPP pools) and clause 8 (MRL pools) of Appendix II of the MRL Order or by EUB letter.

Example, given the following data:

Daily base MRL	= 10.0 m^3/d
Off-target penalty factor	= 0.25
GOR penalty factor	= 0.60
Number of days in the month	= 31

To calculate the adjusted MRL for the above entity:

Monthly base MRL	= Daily base MRL x number of days in the month
	= 10.0 m^3/d x 31 d = 310.0 m^3
Off-target adjusted MRL	= the greater of the monthly base MRL x off-target penalty factor
	or 5.0 m^3/d x number of days in the month
	= the greater of 310.0 m^3/m x 0.25 = 77.5 m^3/m
	or 5.0 m^3/d x 31 d = 155.0 m^3/m
Adjusted MRL	= off-target adjusted MRL x GOR penalty factor
	= 155.0 m^3/m x 0.60 = 93.0 m^3 for the month

See *ID 94-2: Revisions to Oil & Gas Well Spacing Administration* for further details on off-target penalty assessment.

4 Blocks and Projects

Blocks and projects are producing entities containing wells with contiguous drilling spacing units (DSU) of common ownership. Blocks require demonstration of improved oil recovery under primary depletion, whereas projects are schemes for enhanced recovery (e.g., waterflood). These entities are administered and produced as single production entities for the purpose of allowables.

Operators must apply for block or project status in accordance with Part 5 of the Oil and Gas Conservation Regulations. Approval is granted through EUB form B06A: Appendix to Block or Project Approval (see Figure 6), which lists the wells included in the entity. It also shows the DSU size of each well, which together define the outline of the entity. In pools containing more than one project, the MRL for each project within each mechanism is shared according to its assigned area as specified in the Appendix to Approval.

The daily base MRL for each block or project is listed in clause 9 of Appendix II to the MRL Order each month. To obtain the monthly base MRL for an entity, the daily base MRL is multiplied by the number of days in the month and then reduced by any applicable penalties, as described in Section 3. The producing GOR for the entity is calculated based on the total monthly gas production of all the wells divided by the total oil production. When a block or project is established, the cumulative overproduction of each well included in the block or project at the end of the month preceding the formation of the block or project is carried forward into the block or project.

For a change in owner or operator of a block and project, a transfer of approval form, Appendix D of EUB *Guide 65: Resources Applications for Conventional Oil and Gas Reservoirs* must be submitted. Any questions concerning the status of a block or project should be directed to the EUB Resources Applications Group at (403) 297-6934.

4.1 Control Wells

A control well is defined as a well capable of producing oil that is within a block or project and is completed in a DSU contiguous to a DSU containing a producing well outside the block or project.

Control well status is imposed in accordance with *IL 90-10: Revised Procedures for Control Wells* upon written request. In the case of a project, the operator of the affected well must provide evidence that his land is being drained by the well identified for control well status. In the event of a control well being off target, the off-target penalty factor is applied against the block or project allowable and against the control well.

Control well rates are assessed as follows:

- In projects—the control well is assigned a rate equal to the greater of 20 m^3/d or the MRL of wells outside the project as prescribed in the MRL Order.

- In blocks—the control well rate is equal to that assigned to other wells outside the block as prescribed in the MRL Order.

5 Overproduction

The MRL system is administered to preserve conservation and equity within a pool and to provide a level playing field for all operators. The EUB considers overproduction to be any production in excess of the adjusted MRL for an entity. The EUB recognizes that minor overproduction may occur from time to time and therefore no penalty is assessed if overproduction is less than 10% of the adjusted MRL. All overproduction is accumulated to yield the cumulative status.

To discourage overproduction, the EUB applies a penalty (as per Section 5.1) to any entity where the overproduction exceeds 10% of its adjusted MRL. Furthermore, to promote timely retirement of overproduction, the EUB requires that **all overproduction (cumulative status) exceeding 10% of an entity's adjusted MRL must be retired (reduced to zero status) by the end of the third month following the first month of overproduction.** Overproduction is retired by producing less than the adjusted MRL or shutting in the well in the month(s) following overproduction.

Note that underproduction in any month is used to offset the previous month's cumulative overproduction status. However, underproduction may not be carried forward to be used in later months, except during NOWPP.

5.1 Overproduction Penalty

A 50% overproduction penalty is assessed each month that the monthly overproduction exceeds 10% of the adjusted MRL. This penalty is calculated as 50% of the difference between the reported monthly production and 110% of the adjusted MRL. All overproduction, including penalties, must be retired within three months once overproduction exceeds 10% of the adjusted MRL.

Example

Calculation of monthly overproduction penalty for May 2001, as shown in Figure 7, given the following data:

Monthly oil production = 292.8 m^3
Monthly adjusted MRL = 248.0 m^3

Monthly overproduction = monthly production – adjusted MRL
= 292.8 m^3 – 248.0 m^3 = 44.8 m^3
110% of adjusted MRL = adjusted MRL x 1.1
= 248.0 m^3 x 1.1 = 272.8 m^3
Overproduction penalty = (Production – 110% of adjusted MRL) x 0.5
= (292.8 m^3 – 272.8 m^3) x 0.5 = 10.0 m^3

Calculation of cumulative status to May 2001, illustrated in Figure 7:

Prior cumulative status = 15.5 m^3 (April 2001)
Monthly overproduction = 44.8 m^3
Overproduction penalty = 10.0 m^3
Cumulative status = Prior cumulative status + monthly overproduction + overproduction penalty
= 15.5 m^3 + 44.8 m^3 + 10.0 m^3 = 70.3 m^3

5.2 GPP Retirement Rate (GRR)

If GPP is approved, retirement of any outstanding overproduction is at the GPP retirement rate (GRR) commencing with the month GPP is approved. The GRR is defined as the greater of the base MRL or the average operating-day rate of the well during the months overproduced.

Example, as illustrated in Figure 7:

Base MRL = 8.0 m^3/d
Months overproduced = April to July
Production from April to July = 255.5 m^3 + 292.8 m^3 + 302.7 m^3 + 335.5 m^3 = 1186.5 m^3
Producing hours from April to July = 2792 hours (as reported in the volumetric submission to the Petroleum Registry of Alberta)

$$GRR = \frac{\text{Production from months overproduced}}{\text{Producing hours from the months overproduced}} \times 24 \text{ hours/day (hr/d)}$$

$$= \frac{1186.5\ m^3}{2792 \text{ hours}} \times 24 \text{ hr/d} = 10.2\ m^3/d$$

Note that no GOR penalties are applied when calculating the GRR. However, any off-target penalty in effect would apply.

5.3 Enforcement Ladder

To ensure a level playing field for all operators and to promote a more timely retirement of overproduction, the EUB developed an enforcement ladder consisting of four levels for retirement of overproduction. This was introduced in *ID 99-2: Revised Policy on Administration of Oil MRL's and Overproduction*, with its February 2001 amendment *Revisions to Enforcement Ladder for Retirement of Overproduction.* This ladder, shown in Figure 8, describes the four levels of enforcement, EUB actions, industry responsibility, as well as how to be removed from the ladder.

The following example illustrates a well that overproduces and is escalated to Level 2 enforcement. The data for this example are found in Figure 7.

Production month	Level of enforcement	Months overproduced	Cumulative overproduction status	Comments
April 2001		0	15.5 m^3	Well not at Level 1 as cumulative status (15.5 m^3) is < 10% of the adjusted MRL of 240.0 m^3, or 24.0 m^3.
May 2001	Level 1	1	70.3 m^3	Well is at Level 1 because the cumulative overproduction status is > 10% of the adjusted MRL of 248.0 m^3 or 24.8 m^3. All overproduction must be retired (to zero status) within three months (August 31, 2001).
August 2001	Level 2	4	23.3 m^3	Escalated to Level 2 because cumulative status not reduced to **zero** status by August 31, 2001.

See Figure 8 for criteria of escalation to Level 3 and Level 4.

5.4 Allowable Record

The EUB maintains an allowable record for each production entity on MRL. This record should be used as a basis for comparison with the operator's own records. An operator is responsible for the correct maintenance of the allowable records for the wells it operates. Allowable records for all nonconfidential wells are available from EUB Information Services at (403) 297-8190.

A table defining some of the terms on an allowable record is shown as Figure 9.

6 New Oil Well Production Period (NOWPP)

NOWPP provides new oil wells with operational flexibility to gather production data on new wells and is subject to the following conditions:

- NOWPP consists of the first four producing months and commences with the earlier of the first month in which there is new oil production or the on-production month reported through the well status change on the Petroleum Registry of Alberta.
- Base MRL during NOWPP is the greater of 20.0 m^3/d or the reserve-based MRL.
- NOWPP is considered as a single production period for overproduction administration, meaning that underproduction may be carried forward within NOWPP.
- NOWPP expires one year from the on-production month.
- GOR and overproduction penalties are not applied during NOWPP; however, any overproduction incurred during this period must be retired.
- Off-target penalties, if applicable, are applied during NOWPP.
- The GOR penalty factor of the first producing month after the expiration of NOWPP is used to determine the penalty factor for that month and the following three months.
- NOWPP is terminated in the month following any month in which gas flaring exceeds 300 $10^3 m^3$. (This requirement supercedes that set out in *IL 87-9: Revised Procedures for Oil Production Allowable Controls and New Oil Well Production Period*.)
- NOWPP is applicable only to the first well drilled in a subsisting DSU within a pool.
- New wells completed within a block or project are not eligible for NOWPP.
- Upon written notification to the EUB Reserves and Allowables Section, shut-in month(s) within NOWPP may be counted as producing month(s) to reduce overproduction.
- For horizontal wells producing under NOWPP, the MRL is the product of the MRL and the HWM.

7 Gas Allowables

A gas well is normally permitted to produce unrestricted and in accordance with good engineering practices. However, there are three situations when the EUB may issue a gas allowable (GA) order for the purpose of setting the maximum allowed gas production rate for a gas well or wells in a pool:

- when the ultimate recovery of gas may be adversely affected by unrestricted production rates (Section 10.300[1] of the Oil and Gas Conservation Regulations [the Regulations]);

- when a gas well is completed outside of its prescribed target area and it is necessary to apply an off-target penalty to the well's base allowable for equity reasons (Section 4.070[1] of the Regulations, EUB *ID 94-2* and *ID 94-5*); and

- when the EUB has approved a fractional section as a DSU and there is a need to apply an area-ratio production penalty or off-target penalty for equity reasons (Section 4.050[1] and [2] of the Regulations).

Section 10.095 of the Regulations designates that the base allowable for a gas well shall be its maximum daily allowable (Q_{max}). The calculations of Q_{max} is explained in Section 10.300(1)(c) of the Regulations and in EUB *Informational Letter (IL) 85-10*. In all instances above, the penalties are applied against the well's Q_{max} and an annual allowable is assigned based on this Q_{max} and the number of days in the year.

The allowable for an off-target gas well or a fractional section DSU commences on the date that a penalty is applied and may be assigned by letter. An allowable assigned to a gas well or wells in a pool for conservation reasons is effective the date that the GA order is issued. Allowables assigned by letter for nonconfidential wells are coalesced into a GA order issued each year in January. Allowables assigned to confidential wells continue to be issued by letter.

If a production entity is overproduced, the EUB will increase the overproduction status by an amount equal to 0.5 times the overproduction in excess of 10% of the allowable. The overproduction status of a production entity is determined after the production data for the month of December have been filed with the EUB. The allowable calculated for the next allowable period will then be adjusted to reflect the overproduction and any overproduction penalty from the previous allowable period.

Any questions concerning gas allowables should be directed to the EUB Resources Applications Group (403-297-8547).

Example of overproduction penalty for a gas well:

Calculation of penalty at end of accounting period:

Annual allowable	=	25 000.0 10^3 m^3
Annual production	=	30 000.0 10^3 m^3
Overproduction	=	production—allowable
	=	30 000 10^3 m^3 – 25 000 10^3 m^3
	=	5000 10^3 m^3
Production subject to penalty	=	overproduction—10% of allowable (25 000 10^3 m^3)
	=	5000 10^3 m^3 – 2500 10^3 m^3
	=	2500 10^3 m^3
Penalty	=	production subject to penalty x 0.5
	=	2500 10^3 m^3 x 0.5
	=	1250 10^3 m^3
Status at next accounting period	=	overproduction + penalty
	=	5000 10^3 m^3 + 1250 10^3 m^3
	=	6250 10^3 m^3

8 Glossary

Adjusted MRL/Allowable — Maximum rate limitation of production for an entity after penalty factors have been applied.

Base Allowable/Base MRL — The amount of production that, according to a Board Order, could be taken if no penalty factor were to be applied.

Base GOR — Defined in Schedule 6 of Oil and Gas Conservation Regulations using the formula:

$$\text{Base GOR } (m^3/m^3) = Rsi + 1.67 \frac{(Pb + 101.325)}{Tf + 273.15}$$

Block — An area or part of a pool consisting of wells grouped for the purpose of obtaining a common aggregate production allowable.

Board — Alberta Energy and Utilities Board (EUB).

Cumulative Overproduction Status — Sum of all previous months' overproduction plus the current month's overproduction, including any penalty.

EUB — Alberta Energy and Utilities Board (Board)

GOR — Gas-oil ratio is the monthly gas production divided by the monthly oil production.

GOR Penalty Factor — Base GOR divided by the produced GOR.

GPP — Good Production Practice: when production is not governed by a base allowable but is conducted in accordance with sound engineering principles.

GRR — GPP Retirement Rate: the rate at which overproduction is retired once GPP is approved.

HWM — Horizontal Well Modifier is a factor, greater than 1.0, assigned to a horizontal well that is applied to the base MRL.

Net GOR — The ratio of monthly volume of gas flared and/or vented divided by oil production.

Net GOR Penalty Factor — Base GOR divided by the net GOR.

Off-Target	A well that is completed outside its prescribed target area pursuant to the Oil and Gas Conservation Regulations.
Off-Target Penalty Factor	Factor, less than 1.0, that is applied against the base MRL for an off-target well.
Overproduction	Any production in excess of the adjusted MRL.
Project	An area or part of a pool that could qualify for enhanced recovery and is administered as a single production entity for allowable purposes.
Q_{max}	The maximum daily allowable of a gas well, determined in accordance with Section 10.300 of the Regulations and EUB *IL 85-10*.
Target Area	The part of a DSU within which a well may be completed for the purpose of producing oil or gas without reduction of its allowable because of its location.

9 Data Precision

The number of decimal places to be used in calculations are as follows:

Items	No. of decimal places
Adjusted MRL	1
Base GOR	0
BWR	1
Cumulative overproduction status	1
Daily MRL	1
Gas flared/vented	1
GOR	0
GOR penalty factor	2
GRR	1
Monthly oil/gas production	1
Monthly overproduction penalty	1

Note that in rounding, add 5 to the last digit and then drop the last digit of the sum.

Figure 1. Schedule 5, Tabulation of BWRs.

Schedule 5

Tabulation of Basic Well Rates

Effective 1 February 1984

Pool Average Well Depth – M	Basic Well Rate – m^3 per day
0-2000	8.0
2001-2100	8.5
2101-2170	9.0
2171-2230	9.5
2231-2290	10.0
2291-2340	10.5
2341-2390	11.0
2391-2440	11.5
2441-2490	12.0
2491-2530	12.5
2531-2570	13.0
2571-2610	13.5
2611-2650	14.0
2651-2690	14.5
2691-2730	15.0
2731-2760	15.5
2761-2790	16.0
2791-2820	16.5
2821-2850	17.0
2851-2880	17.5
2881-2910	18.0
2911-2940	18.5
2941-2970	19.0
2971-3000	19.5
3001 and deeper	20.0

AR 151/71 Sched. 5:140/72;229/79;264/84

Figure 2. Example of Appendix I to the MRL Order.

EUB Alberta Energy and Utilities Board

Appendix I to MRL Order No. 145

October 2001

1 Field / Pool Name	2 Pool Type	3 Codes			4 Basic Well Rate (m^3/day)	5 Maximum Rate Limitation (m^3/day)	6 Base GOR (m^3/m^3)	7 Special Provisions (See Appendix II)
		Field	Pool	Pool Type				
AMIGO (Continued)								
KEG RIVER B	Prim	0037	788002	00	8.0	GPP		
KEG RIVER C	Prim	0037	788003	00	8.0	GPP		
KEG RIVER E	Prim	0037	788005	00	8.0	8.0	220	
KEG RIVER G	Prim	0037	788007	00	8.0	41.1	250	
KEG RIVER J	WF	0037	788010	20	8.0	GPP		
KEG RIVER K	Prim	0037	788011	00	8.0	GPP		
KEG RIVER O	Prim	0037	788015	00	8.0	GPP		
ANTE CREEK								
DUNVEGAN D	Prim	0055	192004	00	8.0	12.0	130	9a
NORDEGG A	Prim	0055	444001	00	8.0	GPP		
BEAVERHILL LAKE	Prim	0055	744000	00	20.0	GPP		
BEAVERHILL LAKE	SF	0055	744000	10	20.0	GPP		
BEAVERHILL LAKE B	Prim	0055	744002	00	20.0	GPP		
ANTE CREEK NORTH								
TRIASSIC A	Prim	0056	500001	00	8.0	8.0	230	
TRIASSIC C	Prim	0056	500003	00	8.0	GPP		12
TRIASSIC E	Prim	0056	500005	00	8.0	GPP		12a
TRIASSIC L	Prim	0056	500012	00	8.0	8.0	180	
WABAMUN A	Prim	0056	658001	00	14.0	GPP		
ANTELOPE								
DETRITAL C	Prim	0060	350003	00	8.0	GPP		
ARMADA								
UPPER MANNVILLE A	Prim	0062	250001	00	8.0	GPP		
UPPER MANNVILLE O	Prim	0062	250015	00	8.0	GPP		
UPPER MANNVILLE P	Prim	0062	250016	00	8.0	8.0	110	
ARMISIE								
BLAIRMORE	Prim	0070	244000	00	8.0	GPP		12
ASTOTIN								
VIKING H	Prim	0073	218008	00	8.0	GPP		
UPPER MANNVILLE H	Prim	0073	250008	00	8.0	8.0	130	
ATLEE-BUFFALO								
UPPER MANNVILLE A	Prim	0085	250001	00	8.0	GPP		
UPPER MANNVILLE F	Prim	0085	250006	00	8.0	GPP		
UPPER MANNVILLE G	Prim	0085	250007	00	8.0	8.0	70	1
UPPER MANNVILLE P	Prim	0085	250016	00	8.0	GPP		12
UPPER MANNVILLE CC	Prim	0085	250029	00	8.0	GPP		
UPPER MANNVILLE DD	Prim	0085	250030	00	8.0	GPP		12
UPPER MANNVILLE KK	Prim	0085	250037	00	8.0	GPP		
GLAUCONITIC A	Prim	0085	300001	00	8.0	GPP		
GLAUCONITIC B	Prim	0085	300002	00	8.0	8.0	70	
GLAUCONITIC G	Prim	0085	300007	00	8.0	GPP		
GLAUCONITIC H	Prim	0085	300008	00	8.0	GPP		
GLAUCONITIC L	Prim	0085	300012	00	8.0	GPP		
GLAUCONITIC P	Prim	0085	300016	00	8.0	8.0	80	1
AUBURNDALE								
WAINWRIGHT A	Prim	0089	278001	00	8.0	GPP		
WAINWRIGHT B	Prim	0089	278002	00	8.0	GPP		
BADGER								
UPPER MANNVILLE B	WF	0090	250002	20	8.0	GPP		12a, 12c

Figure 3. Definitions of each column in an MRL Order.

Appendix I to the MRL Order

Columns	Definitions
1	Field/pool names as defined by the EUB
2	Recovery mechanism for the pool: Primary Depletion (00) Solvent Flood (10) Water Flood (20) Gas Flood (40)
3	Field, pool, and pool type codes as defined by the EUB
4	Basic Well Rate (BWR) (the lowest unpenalized MRL assigned to a producing oil well in a pool or pool type; related to the average well depth of the pool, as tabulated in Schedule 5 of the Oil and Gas Conservation Regulations (see Figure 1)
5	Maximum Rate Limitation (MRL) (for the wells in a pool or pool type; pools on Good Production Practice [GPP] are not subject to an MRL, unless other directives are specified in Appendix II of the MRL)
6	Base Gas-Oil Ratio (GOR) (as calculated in accordance with Schedule 6 of the Oil and Gas Conservation Regulations)
7	Special provisions applicable to pools or to individual wells or entities in a pool type (the specific clauses are described in Appendix II)

EUB Alberta Energy and Utilities Board

Application for a New Well Base Allowable or Base MRL

Confidential pools and undefined areas only

Submit form in duplicate within 30 days of initial oil production.

Well name _____ Unique well identifier W | | | | | | | | | LE LSD SEC TWP RGE M ES

Field _____ Pool _____ Formation _____

KB elevation _____ m Finished drilling date yyyy mm dd On production date yyyy mm dd

Initial production data	Date yyyy	mm	dd	Hours	Production method	Choke/ strokes	Clean oil production	GOR (m^3/m^3)	Water cut (%)	Oil density (kg/m^3)

Submit any additional supporting evidence of your pool designation.

OPERATOR'S SUBMISSION

FOR EUB USE ONLY

G/O interface ☐ or porosity top ☐	m(KB)		
O/W interface ☐ or porosity base ☐	m(KB)		
Cored interval	m(KB)		
Perforated interval	m(KB)		
Lower cutoffs Ø / K	% / mD		
Assigned area	ha		
H, h	m		
Ø	fraction		
1-Sw	fraction		
1/Boi	fraction		
N	$10^3 m^3$		
Ri	fraction		
RiN	$10^3 m^3$		
Average well depth	m		
Pb	kPa		
Rsi	m^3/m^3		

Estimated reservoir pressure (gauge) kPa _____ and Temperature _____ °C @ _____ m(KB)

Unique well identifier | | | | | | W | | LE LSD SEC TWP RGE M ES

Crude oil density ☐ Light and medium ☐ Heavy

BWR _____ m^3/d Base MRL _____ m^3/d

Base GOR _____ m^3/m^3

Pool designation:

_____

Date (yyyy-mm-dd) Signed by

_____

Contact name Company

FOR EUB USE ONLY Remarks:

_____

per Alberta Energy and Utilities Board

Date approved yyyy mm dd

Figure 4. EUB Form O-38

Figure 5. Allowable record for a horizontal well.

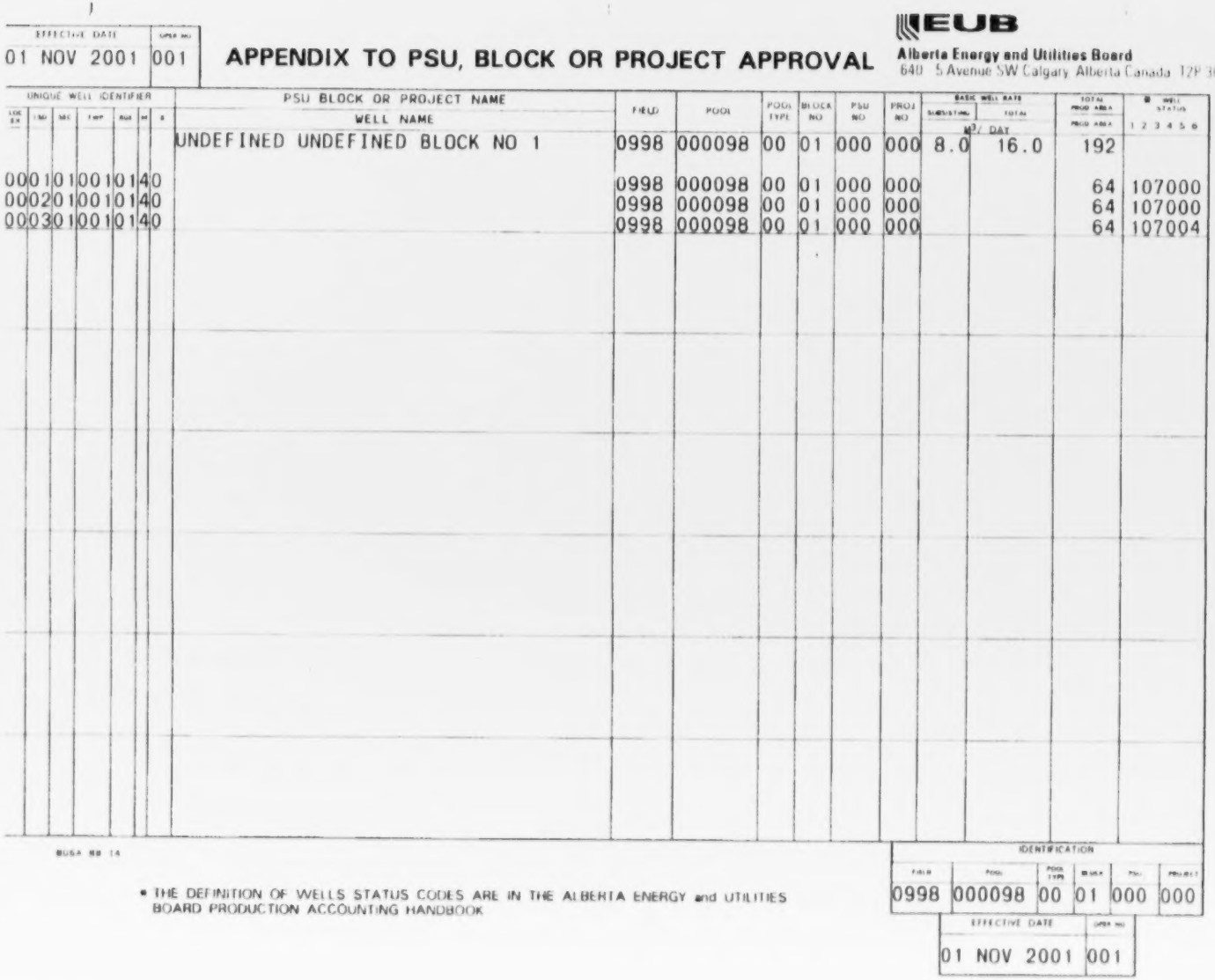
EUB Alberta Energy and Utilities Board

Allowable Record
September 2001

Well Identifier	Field Code	Pool Code	Pool Type	Project	Block	Base GOR	Off-Target Penalty	Horizontal Well Modifier	Operator
00/01-01-001-01W4/0	0998	000098	00	000	000	300	0.0000	2.0	0000

Production Date	Months Over	Net GOR Penalty Relief	Confidential	Remarks
2001-04	0	N	N	Example - well assigned a horizontal well modifier

Month	Oil Production	Gas Production	Prod GOR	Gas Flared	Adjusted MRL	Monthly Over Production	Monthly Penalty	Cumulative OP Status	BWR	Daily MRL	Counter	GOR Penalty	Base GOR
2000-07													
2000-08													
2000-09													
2000-10													
2000-11													
2000-12													
2001-01													
2001-02													
2001-03													
2001-04	1222.0	212.2	174	3.4	1200.0	22.0		22.0	8.0	20.0	11	1.00	300
2001-05	344.4	162.6	172	6.7	1240.0	-295.6		-273.6	8.0	20.0	12	1.00	300
2001-06	1000.0	175.6	176	2.9	1200.0	-200.0		-473.6	8.0	20.0	13	1.00	300
2001-07	1305.6	239.2	183	5.4	1240.0	65.6		-408.0	8.0	20.0	14	1.00	300
2001-08	495.8	90.2	182	2.2	496.0	-0.2			8.0	8.0	21	1.00	300
2001-09	475.7	88.8	187	3.1	480.0	-4.3			8.0	8.0	22	1.00	300



EFFECTIVE DATE: 01 NOV 2001 | OPER NO: 001

APPENDIX TO PSU, BLOCK OR PROJECT APPROVAL

EUB
Alberta Energy and Utilities Board
640 5 Avenue SW Calgary Alberta Canada T2P 3G4

UNIQUE WELL IDENTIFIER (LOC / LSD / SEC / TWP / RGE / M / S)	PSU BLOCK OR PROJECT NAME / WELL NAME	FIELD	POOL	POOL TYPE	BLOCK NO	PSU NO	PROJ NO	BASIC WELL RATE: SHUT-IN	BASIC WELL RATE: TOTAL (M³/DAY)	TOTAL PROD AREA	WELL STATUS 1 2 3 4 5 6
	UNDEFINED UNDEFINED BLOCK NO 1	0998	000098	00	01	000	000	8.0	16.0	192	
0001 01 001 01 4 0		0998	000098	00	01	000	000			64	107000
0002 01 001 01 4 0		0998	000098	00	01	000	000			64	107000
0003 01 001 01 4 0		0998	000098	00	01	000	000			64	107004

RUSA 88 14

* THE DEFINITION OF WELLS STATUS CODES ARE IN THE ALBERTA ENERGY and UTILITIES BOARD PRODUCTION ACCOUNTING HANDBOOK

IDENTIFICATION

FIELD	POOL	POOL TYPE	BLOCK	PSU	PROJECT
0998	000098	00	01	000	000

EFFECTIVE DATE: 01 NOV 2001 | OPER NO: 001

Figure 6. Appendix to Block or Project Approval.

Figure 7. Allowable record with overproduction calculation.

EUB Alberta Energy and Utilities Board

Allowable Record

August 2001

Well Identifier	Field Code	Pool Code	Pool Type	Project	Block	Base GOR	Off-Target Penalty	Horizontal Well Modifier	Operator
00/01-01-001-01W4/0	0998	000098	00	000	000	80	0.0000	1.0	0000

Production Date	Months Over	Net GOR Penalty Relief	Confidential	Remarks
2000-12	4	N	N	Example - overproduced well

Month	Oil Production	Gas Production	Prod GOR	Gas Flared	Adjusted MRL	Monthly Over Production	Monthly Penalty	Cumulative OP Status	BWR	Daily MRL	Counter	GOR Penalty	Base GOR
2000-06													
2000-07													
2000-08													
2000-09													
2000-10													
2000-11													
2000-12	352.4	6.9	20	6.9	620.0	-267.6		-267.6	8.0	20.0	11	1.00	80
2001-01	305.0	3.3	11	3.3	620.0	-315.0		-582.6	8.0	20.0	12	1.00	80
2001-02	323.8	6.2	19	6.2	560.0	-236.2		-818.8	8.0	20.0	13	1.00	80
2001-03	292.9	5.3	18	5.3	620.0	-327.1		-1145.9	8.0	20.0	14	1.00	80
2001-04	255.5	3.4	13	3.4	240.0	15.5		15.5	8.0	8.0	21	1.00	80
2001-05	292.8	6.7	23	6.7	248.0	44.8	10.0	70.3	8.0	8.0	22	1.00	80
2001-06	302.7	2.9	10	2.9	240.0	62.7	19.4	152.4	8.0	8.0		1.00	80
2001-07	335.5	5.4	16	5.4	248.0	87.5	31.4	271.3	8.0	8.0		1.00	80
2001-08					248.0	-248.0		23.3	8.0	8.0		1.00	80

Figure 8. Enforcement ladder for retirement of overproduction.

Amended Enforcement Ladder for Retirement of Overproduction[1] (amended February 20, 2001)—from ID 99-2 Amendment, Appendix 1

Level of enforcement	Occurs when...	EUB action	Required industry response	Example of overproduction situation[2]	EUB responsibility/communication	Removal from enforcement ladder[3]
1	a well has an overproduction status exceeding 10 per cent of its adjusted (penalized) monthly MRL.	Reserves and Allowables Section will send a WARNING NOTICE to the operator. Any applicable penalties will be applied as per EUB *Guide 7-1: Allowables Handbook*.	All overproduction must be retired by the end of the third following month or the well must be shut in.	For a well that overproduced during the month of February 2001, the EUB would send a notice to the operator in mid-April 2001 requiring that all overproduction be retired by the end of May 2001. If an operator cannot retire overproduction by the end of May 2001, the well must be shut in immediately.	Staff provide written instructions to company. Staff notify impacted parties (as required) of event and resolution(s). Staff report annual statistics and performance measures in Work Group.	Operators may receive any number of Level-1 notices without further escalating enforcement, provided that all overproduction is retired within the specified time frame (i.e., by the end of the third following month).
2	a well has not retired **all** overproduction by the end of the third following month, as required in Level 1.	Reserves and Allowables Section will send a Level-2 notice to a company representative with provincial authority[4] requiring that the offending well cease production immediately. Failure to comply with this requirement results in the matter being immediately escalated to Level-4 enforcement.	The operator must confirm in writing to the Reserves and Allowables Section within 5 working days that the well has been shut in and will remain shut in until all overproduction is retired.	For the well that overproduced in February 2001 and had not retired its overproduction by the end of May 2001, the EUB would send a letter to a company representative with provincial authority[4] in mid-July 2001 requiring that the well be shut in and remain shut in until all overproduction is retired.	Staff, with approval of Section Leader with delegated authority or Board Member, provide written instructions to company. Staff notify Group Manager, Executive Manager, and Board of controversial situations, cases with large impact on the company, or potential for media coverage. Staff notify impacted parties (as required) of event and resolution(s). Staff report annual statistics and performance measures in Work Group.	Whichever occurs earlier: • when an operator does not have any well with an overproduction status (exceeding 10 per cent of its adjusted/penalized monthly MRL) for 3 consecutive months, or • 12 consecutive months following the date of the Level-2 notice with no further level 2 occurrences.

(continued)

Level of enforcement	Occurs when...	EUB action	Required industry response	Example of overproduction situation[2]	EUB responsibility/communication	Removal from enforcement ladder[3]
3	an operator already at Level 2 has a subsequent Level-2 occurrence within 12 months of the first Level-2 occurrence, or an operator already at Level 3 has a subsequent Level-2 occurrence within 12 months of the Level-3 enforcement, and the operator shuts in the well(s) immediately after receiving written notification from the EUB.	Enforcement and Surveillance Section Leader will send a letter to a company representative with provincial authority[4] requiring that the offending well be shut in immediately and remain shut in until all overproduction is retired. Failure to comply with this requirement results in the matter being immediately escalated to Level-4 enforcement. Corporate Compliance Group will record the noncompliance record in the EUB Corporate Data Information System (CDIS).	A company representative with provincial authority[4] must provide, in writing at a meeting, the following: • why the noncompliance is recurring, • what the company has done to ensure that this will not occur again, and • what specific actions have been taken by the company to ensure that all of its other wells in the province are in compliance with the requirements of the MRL Order. The company must confirm in writing within 5 working days that the well has been shut in until all of the above matters have been addressed to the satisfaction of the EUB.	For the example above, any second well operated by the company that reaches Level 2 within the next 12-month period (in this case, for production up to May 2002). For an operator at Level 3 that receives a subsequent overproduction notice dated November 15, 2001, the well(s) must be shut in for the entire month of December 2001 (and remain shut in until all overproduction is retired) to avoid escalation to Level 4 of enforcement.	Section Leader or Board Member provides written instructions to company. Staff notify Group Manager, Executive Manager, and Board of controversial situations, cases with large impact on the company, or potential for media coverage. Staff notify impacted parties (as required) of event and resolution(s). Staff report annual statistics and performance measures in Work Group. Staff advise Corporate Compliance Group.	Whichever occurs earlier: • when an operator does not have any well with an overproduction status (exceeding 10 per cent of its adjusted/penalized monthly MRL) for 3 consecutive months, or • 12 consecutive months following the date given in the EUB Level-3 compliance letter with no further Level-2 occurrences.

(continued)

Level of enforcement	Occurs when...	EUB action	Required industry response	Example of overproduction situation[2]	EUB responsibility/communication	Removal from enforcement ladder[3]
4	an operator fails to respond to a Level-2 or Level-3 notice (i.e., noncompliance with that notice), or an operator already at Level 3 has a subsequent Level-2 occurrence and fails to respond immediately to a written notice from the EUB.	Corporate Compliance Group will issue a closure order for the well(s) and the company's status will be changed to "Refer."[5] Corporate Compliance will record the noncompliance record in the EUB Corporate Data Information System (CDIS).	The company must meet all of the requirements listed for Level 3 and submit an acceptable corporate lasting improvement plan to the EUB's Corporate Compliance Group. No operations will be permitted on site until EUB gives written approval. Well will remain shut in until all overproduction has been retired. Closure order and "Refer"[5] will remain in effect until an action plan for overproduction avoidance and a corporate lasting improvement document have been submitted and approved.	For an operator at Level 3 that receives a subsequent overproduction notice from the EUB dated November 15, 2001, and fails to respond immediately by shutting in the well, Level-4 enforcement would be initiated by EUB staff in early February 2002.	Corporate Compliance advises appropriate Executive Manager, involved staff, and the Board prior to closure order issuance and Refer[5] status. Closure order/Refer[5] status signed by Corporate Compliance Group Manager, Enforcement Section Leader, Enforcement Advisor with delegated authority, or a Board Member is sent to senior company representative with provincial authority (VP/Pres). Staff notify Group Managers, Executive Managers, and Board of the Refer[5] status and additional requirements for application processing. Board Member may be requested to participate in enforcement meeting. Staff notify impacted parties (as required) of event and resolution(s). Staff report annual statistics and performance measures in Work Group.	Operators are essentially returned to Level 3 of the enforcement ladder once all requirements of Level 4 have been met. For example, an operator that complies with all Level-4 requirements and subsequently does not have any well with an overproduction status (exceeding 10 per cent of its adjusted/penalized monthly MRL) for 3 consecutive months would be removed from the enforcement ladder, as per Level 3.

[1] Overproduction represents the sum of the absolute overproduction volume plus any (50 per cent) monthly production penalties. See EUB *Guide 7-1: Allowables Handbook* for details.

[2] Production records for a given month are not available on the EUB database for approximately 5 to 6 weeks following the end of that month. This causes an unavoidable delay in EUB initiation of any enforcement action.

[3] Operators will be required to notify the EUB in writing (Attention: Enforcement and Surveillance, Resources Applications) when they believe that this criterion has been met.

[4] A company representative who has authority to implement measures provincially on a company wide basis such as the Vice-President or President.

[5] "Refer" status means that the EUB will consider the company's SERIOUS noncompliance record when deciding to approve or deny any pending or future applications submitted to the EUB involving the company.

Figure 9. Terms on an allowable record.

Allowable Record

Terms	Definitions
Horizontal well modifier (HWM)	HWM is a factor assigned to a horizontal well. For vertical wells, the HWM is shown as 1.0.
Operator	Code of the operator of the entity and one who is responsible for any overproduction. For allowable purposes, operator is the company reporting the production data.
Production date	The earlier of the well's on-production date as specified on the well status change on the Petroleum Registry of Alberta or the date of first production.
Months over	Number of months the cumulative overproduction status exceeds 10% of its adjusted MRL or when overproduction is not retired after exceeding 10% of the adjusted MRL.
Net GOR penalty relief	Approval of net GOR penalty relief.
Confidential	Confidential status of the well.
Gas flared	Volume of gas flared or vented.
Adjusted MRL	Monthly MRL for the entity after all applicable penalties.
Monthly overproduction	Difference between the adjusted MRL and oil production.
Monthly penalty	Penalty assessed on overproduction exceeding 10% of the adjusted MRL.
Cumulative overproduction status	Sum of previous and current month's overproduction, including any penalty.
Counter	For EUB use in adjusting calculation of the MRL.
GOR penalty	GOR penalty factor applied to the base MRL.